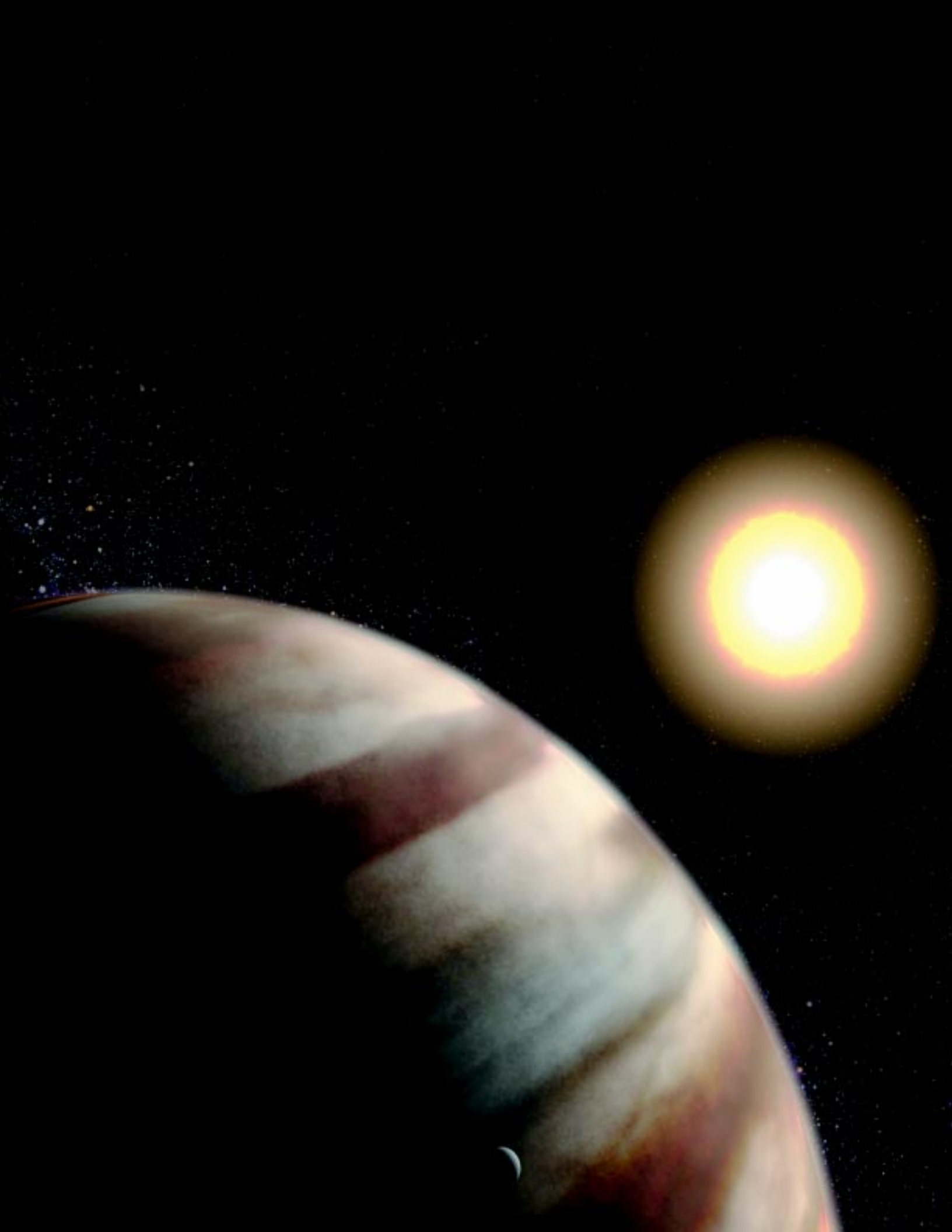
SPACE SHUTTLE PROGRAM

Process Control Focus Group

2002 Annual Report



Space Shuttle Program

Focus Group

2002 Annual Report

Prepared by
The Process Control Focus Group

Approved by:

Joyce Rozewski, Manager
Space Shuttle Program Logistics
Kennedy Space Center, Florida

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Executive Summary

The Process Control Focus Group (PCFG) is embarking on the fourth year of activities dedicated to increasing awareness of process control and reducing the number of process escapes across the Space Shuttle Program (SSP). The safety and reliability of SSP hardware/software continues to increase due in part to the efforts of the PCFG.

The National Aeronautics and Space Administration (NASA)-led PCFG has representatives from each of the SSP prime contractors and NASA centers. The following have participants on the team: Johnson Space Center (JSC), Kennedy Space Center (KSC), Marshall Space Flight Center (MSFC), Stennis Space Center (SSC), United Space Alliance (USA), Boeing Rocketdyne, ATK Thiokol Propulsion, Hamilton Sundstrand Space Systems International, Pratt & Whitney, and Lockheed Martin Space Systems Company, Michoud Operations. Boeing Human Space Flight & Exploration also participates as a major subcontractor to United Space Alliance.

There are two new Associate Members to the PCFG this year representing the NASA agency-wide Supplier Outreach Process Control (SOPC) initiative being led by the Jet Propulsion Laboratory (JPL). The SOPC has benefited and capitalized on the experience and knowledge of the PCFG. While the focus of the SOPC is towards other NASA programs, there are a core group of suppliers that support the supply chains of various sectors of the aerospace industry, and the Space Shuttle Program, who will benefit from the synergism of these two teams.

The one-on-one personal visits with suppliers continue to be the preferred method of communicating the process control message. It is during these visits that awareness products are distributed, and lessons learned and best practices are shared. An additional forum is a supplier symposium, which the prime contractors conducted individually prior to this year when the first joint SSP Supplier Symposium was held. As a result of the huge success of this first symposium, another symposium has been scheduled for February 4-6, 2003 at Kennedy Space Center, Florida where attendance is expected to reach nearly 500 participants from across the SSP. “Pioneering for the Future” is the theme of the symposium, which reinforces the importance of process control.

Through these outreach efforts, the Process Control Focus Group continues to make great strides towards changing the culture by encouraging the sharing of lessons learned and reemphasizing the importance of paying attention to detail and bringing forward any concerns. It takes constant dedication and diligence of everyone across the SSP to ensure a safe and reliable program for the future.


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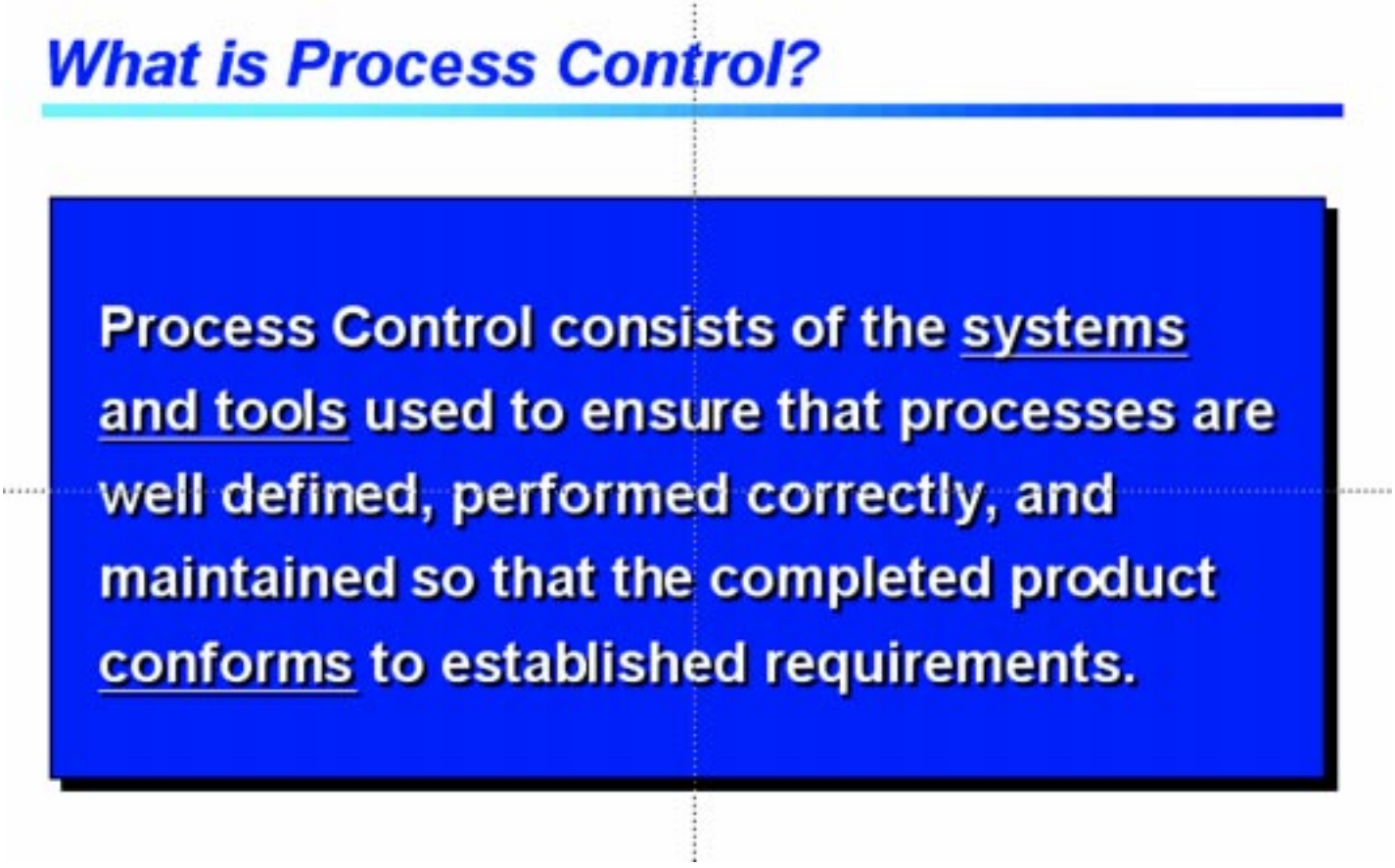
Introduction

The Process Control Focus Group (PCFG) was established by the NASA SSP to coordinate process control activities across the entire Space Shuttle Program. The team identified critical processes, developed and released the Process Control Management Plan, which contains the minimum standards for process control including examples of best practices from across the program, and has produced several awareness products that include videos, posters, and an interactive mini-disk.

The mission of the Process Control Focus Group is to reduce risk to the Space Shuttle Program by reducing and/or eliminating process escapes. This report will highlight the activities during 2002 that were employed to reach that goal.



Program Management

The SSP Process Control Management Plan, NSTS 37358, was base-lined in December 2000. This document contains eight standards considered to be the minimum requirements necessary to maintain process control and includes several examples of best practices from across the program. Through sharing these best practices and providing detailed information, the primes have implemented several of these programs, thereby improving internal process controls and promoting consistency across the program. The plan also includes sections on communication and lessons learned, which are vital elements to preventing process escapes from re-occurring.

The PCFG continues to have representatives from each of the NASA Centers and the prime contractors of the SSP. This year the team membership has seen some changes with the addition of two associate members, and a gradual transition of the leadership role effective January 2003. New representatives for the primes and major subcontractor have also taken place this year with only seven original chartered members still participating. The change in membership has proved beneficial by providing new insight and varied experience to the team without negatively affecting the momentum or focus.

The face-to-face meetings conducted throughout the year afford the team the opportunity to discuss process escapes, lessons learned, and brainstorm new concepts for awareness products and process control tools that will have an impact on the culture of the workforce. Scheduled telecons are conducted monthly and are an additional forum to review and status action items and bring forth new issues and concerns. The process control intranet is an internal tool, which provides a mechanism to post documents for review, meeting agendas/minutes, and calendar of events as well as communicate with other teams working on process control initiatives.

Suppliers are able to access two websites to gather additional information and tools to assist them in improving process control. The **www.CountdownOnline.tv** site contains a description of the multitude of awareness products, including clips from the various videos, general information concerning process control, and is the conduit to submit an individual nominee for the Celebrity Watch video segment. The **http://process.nasa.gov** site provides various resources including the SSP Process Control Standards & Practices handbook, PCFG member contact listing, and links to other sites for lessons learned and additional tools. Traffic on these sites continues to rise indicating an increase of awareness.

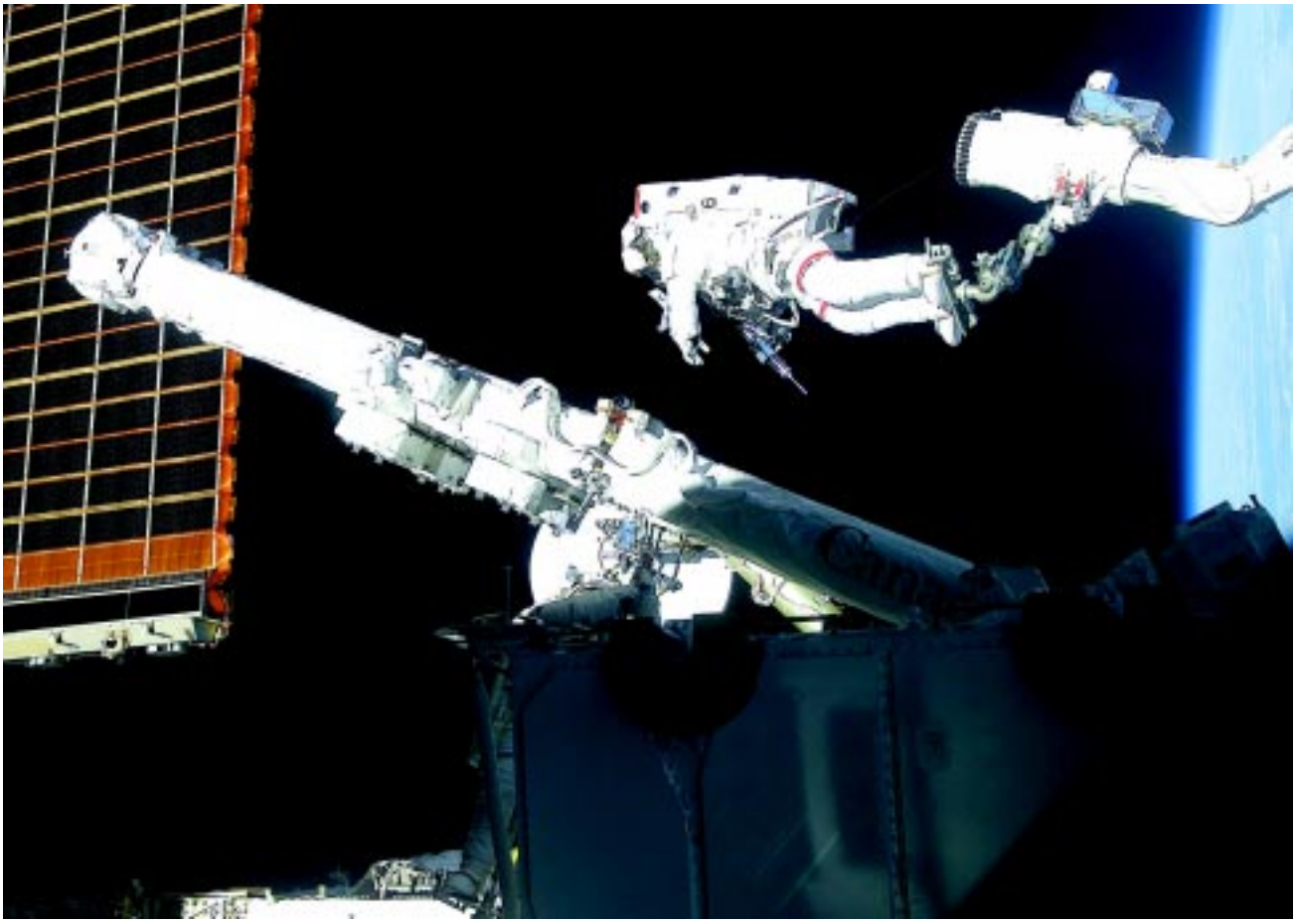
Partnering

The activities and accomplishments of the Process Control Focus Group has been recognized across the agency and is being modeled after by the NASA Agency-wide Supplier Outreach Process Control (SOPC) team. The focus of the SOPC is namely other unmanned (robotic exploration) NASA space programs, which share many of the same suppliers as the SSP, but expands the supply base even further including universities and other educational institutions. The Jet Propulsion Laboratory (JPL) has taken the lead in this new initiative and has joined the PCFG as associate members. The synergism and enthusiasm of these two teams working together and leveraging knowledge, expertise, and resources, will ensure the process control message will penetrate far beyond the SSP. The Missile Defense Agency has also expressed interest in these efforts. This teaming with other NASA and external space programs provides tremendous leveraging capability, especially among a key, core group of suppliers that support the supply chains of many sectors of the aerospace industry.

NASA Agency and other Aerospace Affiliations

The PCFG continues to participate in the Quality Leadership Forum (QLF) established by the Office of Safety and Mission Assurance at NASA Headquarters. The participants represent not only the Space Shuttle Program, but also other programs including the military. This open forum stimulates free thought and fosters the exchange of information, experiences, and ideas. Process escapes occur across all programs and often in very similar ways, which reinforces the importance of sharing best practices and lessons learned with as many stakeholders of the aerospace community as possible in order to prevent repeated escapes.

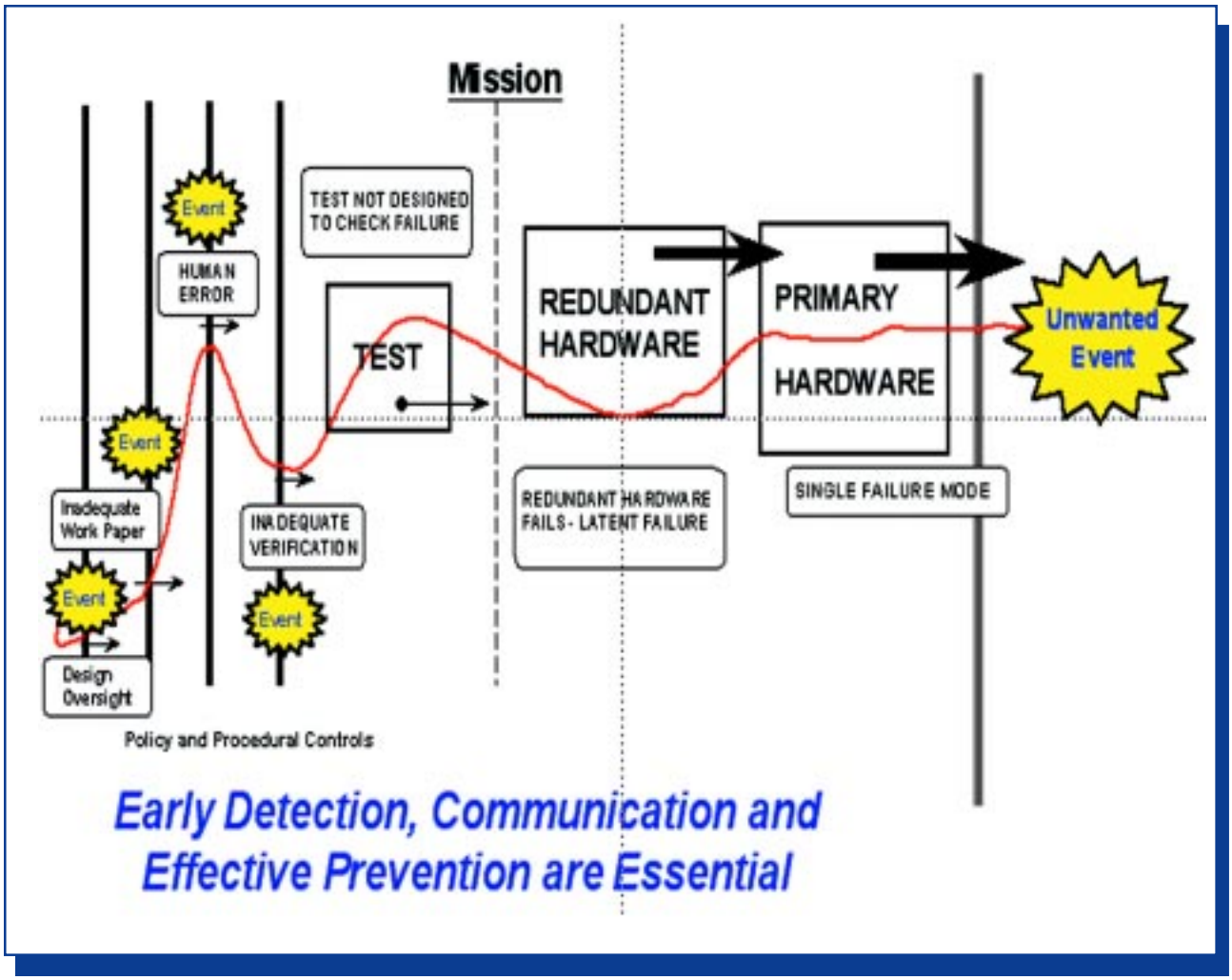
Several participants of the QLF are also directly or indirectly affiliated with other organizations, such as the Aerospace Industries Association (AIA), Americas Aerospace Quality Group (AAQG), and the International Aerospace Quality Group (IAQG). These organizations are responsible for developing and standardizing requirements internationally. It is imperative that these organizations have a full understanding of process control related concerns in order to establish requirements designed to prevent further escapes. The PCFG will continue to participate in these forums.



Awareness Campaign

A major component of eliminating process escapes is to increase awareness of the importance of paying attention to detail and asking questions when something doesn't look or feel right. Systems are in place to detect non-conformances, but these systems are not fool proof. It takes the dedication of individuals, who have pride in what they do, who understand and comply with always following procedures as written or receiving proper authorization for any proposed change to a process to ensure that escapes do not occur.

The diagram below depicts the checks and balances that are established to detect non-conformances, however failures still have the potential of snaking through the system and causing an unwanted event. It is desirable to push the detection to the earliest possible point in the process to reduce cost and schedule impacts.

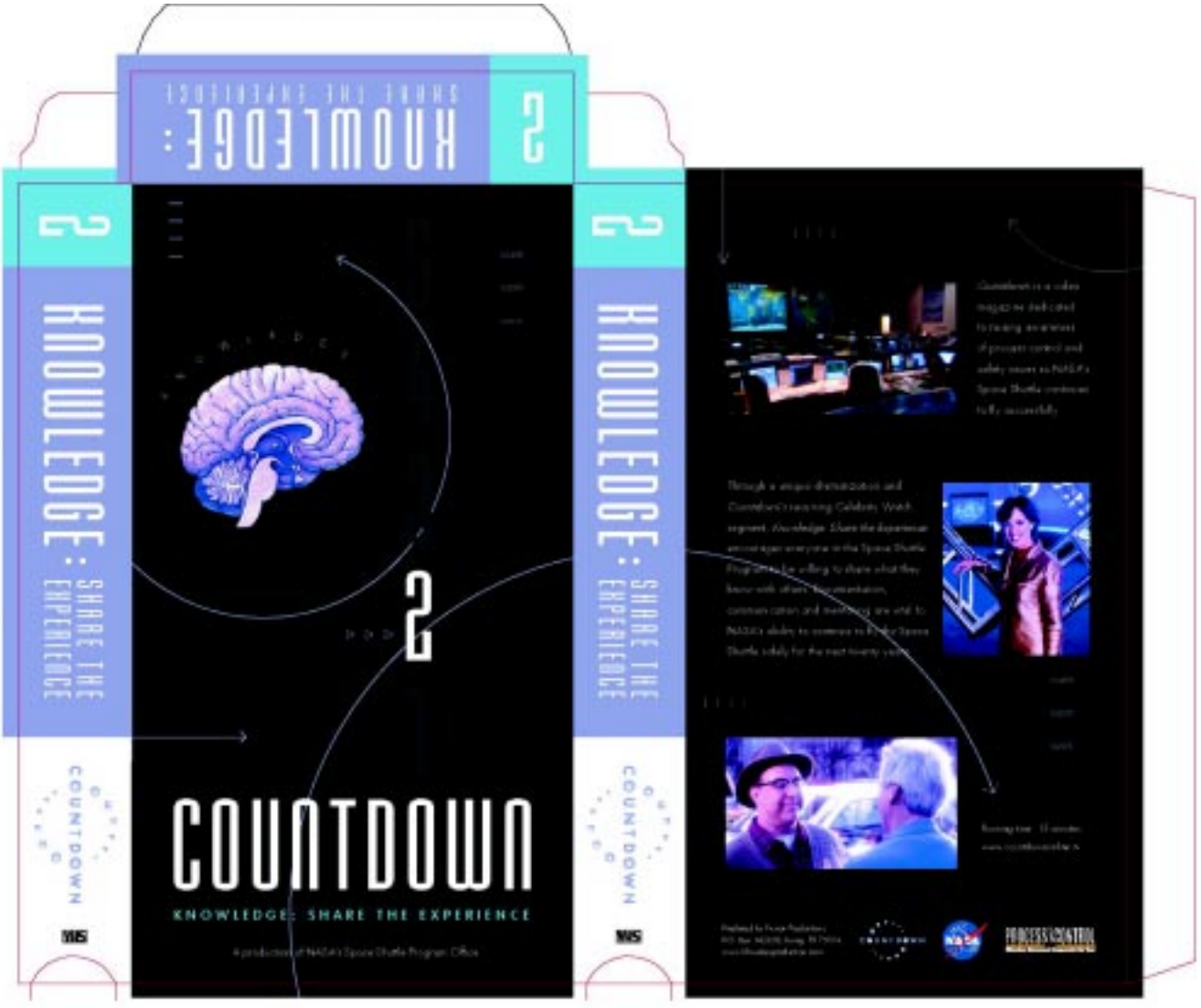


An aggressive multi-media awareness campaign targeting the individual working “on-the-floor” has been in place since 2000. The goal of the PCFG is to reach out to the entire supply base of end-item suppliers and end-item processors every three years, preferably face-to-face. This one-on-one interaction has proven to be very effective and rewarding. The chart to the right reflects that the PCFG has reached more than 100% of the end-item suppliers through these face-to-face visits, supplier symposiums, and additional contacts where the process control message is given.

Last year was the first joint Space Shuttle Program Supplier Symposium focusing on process control. Suppliers from across the program were in attendance and heard a unified process control message. This approach was so successful that another Supplier Symposium is scheduled for February 4-6, 2003 at Kennedy Space Center, Florida. Attendance this year is expected to increase to nearly 500 individuals. Process Control is once again an important element of the symposium theme, “Pioneering the Future”.

Awareness Products

A variety of products, such as videos and posters have been developed to capture the attention and instill the importance of process control to each and every individual working on the SSP. The latest video, “Countdown 2: Knowledge – Share the Experience” was released in September, 2002 and addresses the critical issue of knowledge management. It emphasizes the necessity of properly documenting processes and encourages individuals to share their knowledge of the job. A fictional segment of the video poses the questions, “What if you weren’t here tomorrow? Would someone know how to perform your job”? Improperly documented processes and lack of knowledge transfer is a risk to the SSP as well as other programs with aging technology. “Countdown 2” addresses this program risk and illustrates the necessity for strengthening mentoring programs.



Another product released mid-year was the Process Control Interactive Mini-Disk. It was designed to reach individuals with the process control message in an entertaining, engaging, and inspiring manner. The CD includes clips from previous videos, a space trivia game, which includes questions relating to process control, and website addresses for additional information. The feedback has been tremendous and has proved to be successful as evidenced by a sharp increase in website activity.

Process Control Tools

While the awareness products play an important role, it is equally important to provide the supplier with some tangible tools that provide guidance on ensuring an adequate process control program is established. The SSP Practices & Standards booklet provides the supplier with the eight standards and various examples of best practices from across the program to satisfy the standard. The team also felt it was important to not instruct the supplier "how", but rather "what" to do regarding process control, and to enable the supplier to make the determination on what best fits their business. This booklet, targeted for supplier management, is available on-line at process.nasa.gov in addition to being provided during supplier visits.

The 8 Standards card is designed to be posted on bulletin boards throughout the facility as a quick reference for the standards and lists the process.nasa.gov website for further details. The PCFG strives to reach both management and the general workforce and has accomplished that with these two products.

Team Effectiveness

The efforts of the PCFG are addressing culture and behavior, similar to a “no smoking” or Foreign Object Debris (FOD) campaign. It typically takes a few years before a downward trend is identified, which can be attributable to the awareness activities. It is much easier to measure something tangible, such as conforming vs. non-conforming hardware.

The PCFG has established a set of metrics that are divided into two categories: awareness and performance. The awareness activities include the number of supplier visits, symposiums, products distributed, and the cumulative number of visits against the plan.

The performance metric that is directly linked to the efforts of the PCFG is the process escapes being reported as part of the Preventive/Corrective Action Review (PCAR). The PCAR process was implemented shortly after the initiation of the PCFG and has evolved over the past year to include process escapes relating to cost and schedule. The PCFG will focus specifically on the hardware/ software process escapes. As a result of changes to the definition of a process escape (see below) and the increased attention, the number of process escapes has not declined, but has remained steady. This result was expected, however it is predicted that the number of process escapes across the program will begin to decline as the process control awareness continues and the PCAR process stabilizes.

Definition of Process Escape per NSTS 07700, Volume 1, Revision G

5.4.5 Process Escape

Process Escapes are an indicator of the adequacy and effectiveness of Space Shuttle processes and, as such, are an important element of risk management review. They are defined as any technical, schedule, or cost issue that is found after it should have been determined by established management processes. Technical issues include conditions associated with performance, safety, quality, engineering, procurement, and processing of all systems utilized by the SSP. Schedule and cost issues include any internal or external conditions that affect SSP commitments or mission success.

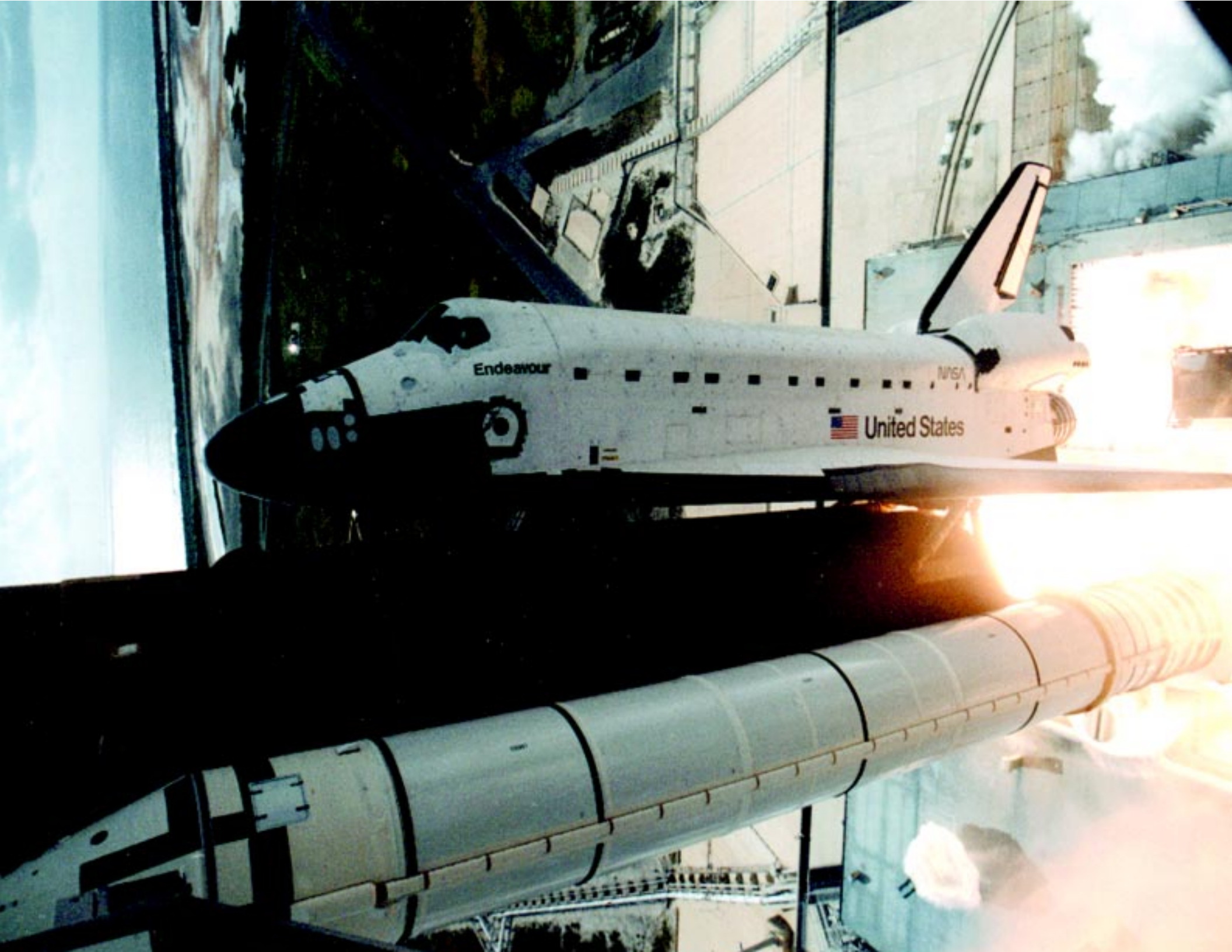
Established management processes are defined as activity performed in accordance with approved management plans, board and panel charters, routine surveillance activities, or planned assessments. Process escapes include problems or conditions found during surveillance sampling, inspection, or audit after acceptance of the product or service. Also, if an assessment determines that the problem or condition would not have been identified during execution of established management processes, the condition will be considered a process escape.

SSP elements and projects are responsible for tracking and eliminating process escapes. Process escape trend analyses shall be reported at the SSP quarterly preventive/corrective action review Program Review Control Board (PRCB).

To ensure the members of the PCFG are aware of all process escapes from across the program, the items from the PCAR are discussed in length including the cause and lessons learned from those events. As discovered from previous escapes, the potential for a similar escape to occur affecting another prime contractor is possible due to hardware/software similarity and common suppliers. In addition, a prime may perform the same or similar processes and would benefit from any lessons learned.

The PCFG will trend process escapes by categorizing the items with a risk score of 12 or above into one of the five essential components of process control: people, environment, material, methods/instructions, and equipment. Although these categories are high-level, it points to areas requiring improvement in the methodology or approach to the awareness products and/or tools. There are typically several factors involved into why a process escape occurs, but to simplify this process the team has agreed to select a single category. This approach may be modified as appropriate.

The goal of the PCFG is to develop a set of standardized metrics that provide insight into the health of the overall program relating to process escapes. The prime contractors have been working together to enable a “roll-up” of this information that represents the program in lieu of individual fragmented data. Additional metrics may be considered in the future.


Endeavour
NASA
United States

Forward Planning

Awareness Products

The PCFG is addressing culture and human behavior and continuously strives to engage individuals through various techniques. For instance, the video series, Countdown, contains a segment entitled, “Celebrity Watch”. This portion of the video highlights an individual or group who called attention to something that didn’t look right or made the decision to report a problem or concern that ultimately prevented a process escape or serious condition from occurring. These folks are considered the real “celebrities” in the process control effort, and to further promote and reward this behavior, the PCFG is developing a “Celebrity Watch Certificate” that affords the team the opportunity to recognize more individuals from across the program. This new program is being developed and will be deployed in 2003.

The sharing of lessons learned has proved beneficial, but can be difficult to present in a memorable or relatable way during a supplier visit. Experience indicates that if an escape is presented in a “story” format including pictures, they are easy to remember and therefore more effective. The concept being developed is to select candidates from the escapes being discussed during the face-to-face meetings and prepare a one-page “story” to be shared with suppliers. The specific guidelines and format continue to be developed.

Additional Tools

Feedback from suppliers is that they are looking for tools to aid them in developing a stringent process control program. While the SSP Standards & Practices handbook is a beginning, the PCFG and SOPC would like to provide a comprehensive toolbox for the supplier to select from. An outside organization experienced in developing training material has been contracted to develop a “Pocket Guide” that will provide basic information and overall structure on how to implement various methods/ techniques for process control in the aerospace production/operations industry. The PCFG and SOPC are collaborating on this initiative and anticipate providing the initial installment at the SSP Supplier Symposium in February 2003.

Team Effectiveness

To obtain unbiased information regarding the penetration of the message to the supply base, the PCFG is working with a consulting firm specializing in preparing and analyzing surveys. The desired outcome of the survey is to determine the level of penetration of the awareness products, knowledge of process control, and if behaviors have changed due to the efforts of the PCFG. This survey will be sent to randomly selected suppliers and prime contractors and will be divided into management and workforce. Statistics can be provided on 100-150 respondents from each category with 40% being the average response rate. The survey will be completed in early 2003.

Appendix A

PCFG Members:

Johnson Space Center
Joyce Rozewski, Team Lead
Jon Cowart, Team Lead
Thomas Malatesta
Anh Huynh

NASA Headquarters
Thomas Whitmeyer

Kennedy Space Center
Terry Keeney

Marshall Space Flight Center
Rick Williams
Ken Crane

Stennis Space Center
Mike Smiles
Clifford Arnold, Jr.

ATK Thiokol Propulsion
Keith Foulger
Glen Curtis

Boeing Rocketdyne
John DeGiovanni
Neil Bussiere
Robert Sobieski

Boeing Human Space Flight & Exploration
James Shearer

United Space Alliance
Tammi Belt
Lililee Johnson

Hamilton Sundstrand Space Systems International
Michael Gemme
Lionel Ribeiro

Lockheed Martin Space Systems Company, Michoud Operations
Shailesh Parikh
Kenneth Bornstedt
Mike Amman

Pratt & Whitney
Dan Specksgoor
Dan Dannecker

Fusion Productions
Todd Sims

Associate Members:

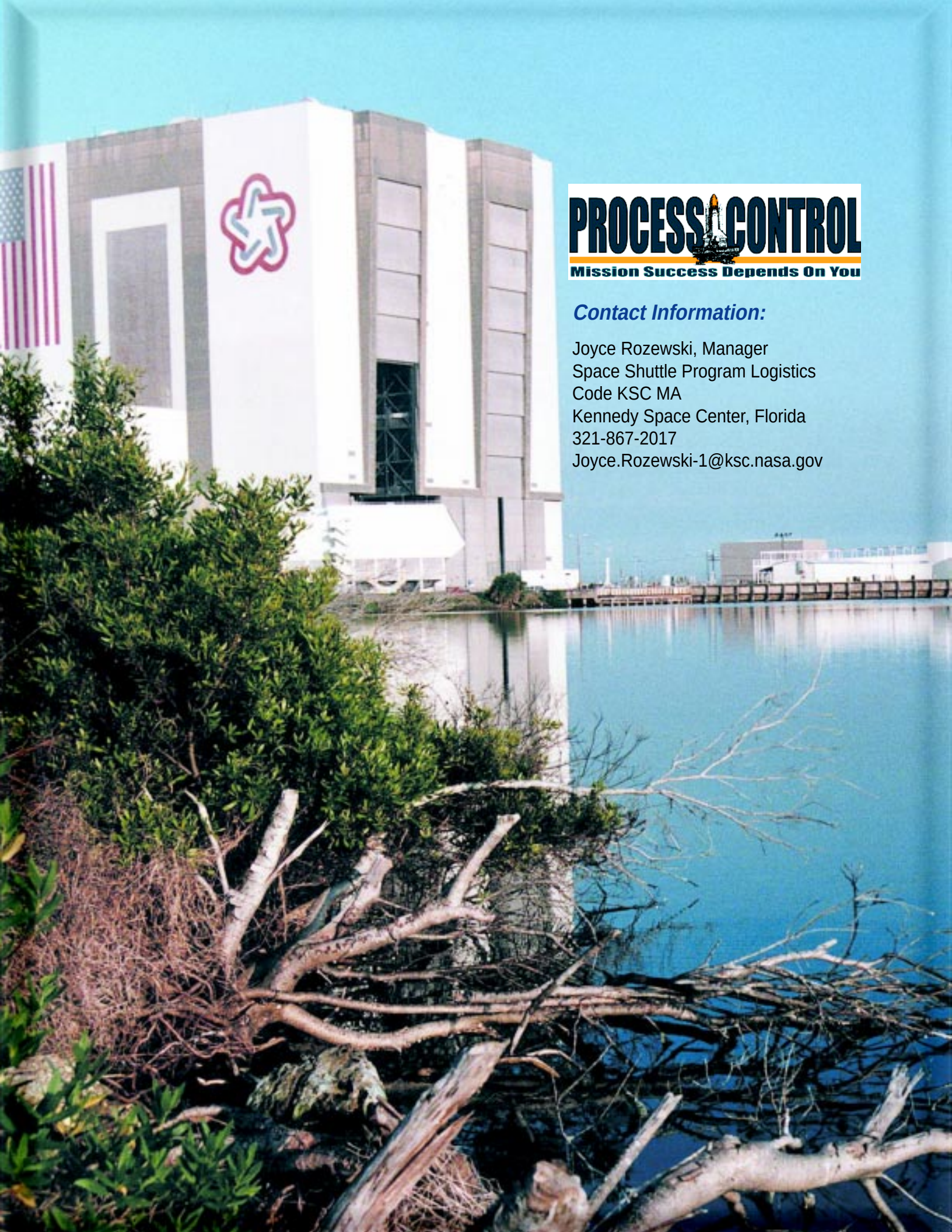
Jet Propulsion Laboratory
Harrel “Buck” Crenshaw
Kien Nguyen

Appendix B

Acronyms and Abbreviations

AAQG	Americas Aerospace Quality Group
AIA	Aerospace Industries Assoc.
FOD	Foreign Object Debris
IAQG	International Aerospace Quality Group
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KSC	Kennedy Space Center
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
PCAR	Preventive/Corrective Action Review
PCFG	Process Control Focus Group
PRCB	Program Review Control Board
QLF	Quality Leadership Forum
SOPC	Supplier Outreach Process Control
SSC	Stennis Space Center
SSP	Space Shuttle Program
USA	United Space Alliance


PACEPORT



PROCESS CONTROL

Mission Success Depends On You

Contact Information:

Joyce Rozewski, Manager
Space Shuttle Program Logistics
Code KSC MA
Kennedy Space Center, Florida
321-867-2017
Joyce.Rozewski-1@ksc.nasa.gov